NTSE 2017 SOLUTIONS – Stage I (Andhra Pradesh State)

(For class X Students)

MENTAL ABILITY TEST

1. 13, 74, 290, 650

$2^2+3^2=13$

$5^2+7^2=74$

$11^2 + 13^2 = 290$

$17^2 + 19^2 = 650$

$23^2 + 29^2 = 1370$

2. 1, 11, 35, 79

General term = $n^3 + n^2 - 1$

$5^3 + 5^2 - 1 = 125 + 24 = 149$

3. 1, 5, 15, 34

General term = $\frac{n(n_2 + 1)}{2}$

$\frac{5(26)}{2} = 65$

4. 3, 13, 31, 57

3 13 31 57

10 18 26

8 8

Next term = 57 + 34 = 91

5. 3, 35, 104, 209

3 35 104 209

33 69 105

36 36 36

Next term = 209 + 141 = 350

6. A – BBC – AAB – CCA – BBCC

ACBA

7. BC–BBC–B–CCB

= BCCB / BCCB / BCCB

= CBCD

8. C – BBB – ABBBB – ABBB –

CA / BBBB / CA / BBBB / CA / BBBB

= ABCCB

9. C – BCCD – CCDB – CDBCC – BC
CD / BCCD / BCCD / BCCD / BCCD / BC
= DBCD

10. BAAB / BAAB / BAAB
= ABBA

11. If the order is
× + =
Then 6 × 3 + 4 = 22 is true

12. + − =
as 12 + 3 – 4 = 11

13. ÷ + =
as 16 ÷ 4 + 3 = 7

14. + − =
as 7 × 3 − 8 = 13

15. ÷ + =
as 15 ÷ 3 + 4 = 9

16. $32 + 31 + 30 + 28 = 121 = (11)^2$
$70+72+73+74 = 289 = (17)^2$
$112 +108 + 100 +175 = 441 = (21)^2$

17. $1^3 +2^3 +3^3 +4^3 =100$
$1^2 +2^3 +3^3 +6^3 =289$
$1^3 +5^3 +6^3 +7^3 =685$

18. HCF of (12, 36, 42, 48) = 6
HCF of (14, 35, 49, 63) = 7
HCF of (30, 45, 60, 75) = 15

19. 7–5+11=9
13–9+6=10
11–14+7=4

20. 5+12+13=30=|3–0|=3
13+9+4=26=|2–6|=4
7+5+16=28=|2–8|=6

21-25.
A → 2 (as 2 is common number in code for ATRNP & ABLMS)
M → 4 (as 48 is common number in code for MSPTQ & ABLMS)
S → 8 (as 48 is common number in code for MSPTQ & ABLMS)
N → 7 (as 1 is common number in code for PTQAB & ATRNP)
P → 1(as 1 is common number in code for PTQAB & ATRNP)

26-30.

D is father of A and grandfather of F

So, A is father of F then D, A are two fathers

C is sister of F. So, C is daughter of A.

Only one mother O, it is evident that E is wife of A and hence the mother of C and F. E is mother

F is the son of A

A made, B is brother → male of D, E → male

F male (as he is brother) Total 4

31. KMF → LLH

Jump → 1st letter → 1

2nd letter ← 1

3rd letter → 2

∴ RMS → SLU

32. GFH → EGG

1st letter ← 2

2nd letter → 1

3rd letter ← 1

∴ HRT → FSS

33. UVST → WTUR

1st letter → 2

2nd letter ← 2

3rd letter → 2

4th letter ← 2

34. News paper → editor
Film → Director

35. Smoke → Pollution
War → Death

36. -1

37. 4

38. 4

39. 5

40. 2

41. 5

42. 5

43. 4

44. 4

45. 4

46. 1

47. 5

48. 3

49. 1

50. 3

PHYSICS

101. (4)

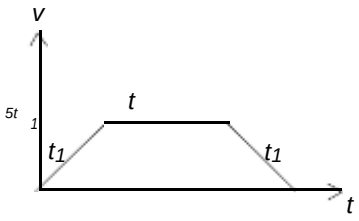
$t + 2t_1 = 25$.....(1)

$2 \times \frac{1}{2} \times 5t_1^2 + 5t_1 .t = \frac{72 \times 1000}{60 \times 60} \times 25$

$t_1^2 + t_1 .t = 100$.....(2)

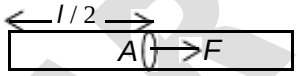
From eq. (1) and (2)

$t_1^2 - 25t_1 + 100 = 0 \quad \Rightarrow t_1 = 5s \qquad t = 15s$



102. (4)

$F = \rho A . \frac{l}{2} \alpha \qquad \frac{F}{A} = \frac{1}{2} \rho l \alpha$



103. (1)

Refraction surface (1)

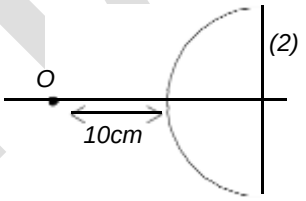
$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R} \qquad v = -30$ cm

At surface (2)

$u = -40$ cmApparent shift = $\frac{40}{3}$ cm

Distance of image from surface (2)

$= 40 - \frac{40}{3} = 26.67$ cm



104. (2)

In centre of mass frame, equal and opposite force acts m both blocks.

In centre of mass frame, if the force on the block is F, then maximum expansion = $\frac{2F}{k}$

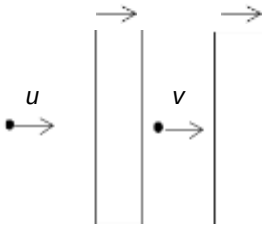
105. (2)

$0.02u = 1.v_1 + 0.02v$.....(1)

$0.02v = (2.98 + 0.02)v_1$.....(2)

Solving eq (1) and (2), $v = \frac{3}{4}u$

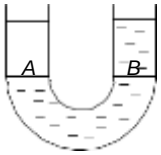
Percentage loss in velocity = $\frac{u - v}{u} \times 100 = 25\%$



106. (1)

Pressure at point A = pressure at point B

$\rho_1 gh_1 = \rho_2 gh_2 \quad \Rightarrow \rho_1 = \rho_2$

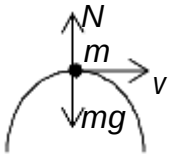


107. (3)

$mg - N = \frac{mv^2}{R}$

For maximum speed $N = 0$.

$\Rightarrow \frac{mv^2}{R} = mg \Rightarrow v^2 = Rg \quad v = \sqrt{Rg} = 14\ m/s$



108. (3)

$$r = \frac{mv}{qB}$$

The particle enters region–3 if $r > l$

thus $v > \frac{qlB}{m}$

Path length in region–2 is maximum if $r = l$

Time spend in region–2 if the particle returns back to region–1,

$$t = \frac{\pi r}{v} = \frac{\pi m}{qB}$$

109. (4)

$R_{eq} = 10\Omega$

$i = 1A$

$v_{12\Omega} = 10 - 1 \times 6 = 4v$

110. (2)

$$3K.\frac{100-T}{l} = 2K\frac{T-50}{l} + K\frac{T-0}{l}$$

$$\Rightarrow T = \frac{200}{3}°C$$

111. (4)

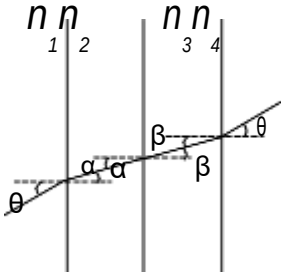
$$\frac{\sin\theta}{\sin\alpha} = \frac{n_2}{n_1}$$

$$\frac{\sin\alpha}{\sin\beta} = \frac{n_3}{n_2}$$

$$\frac{\sin\beta}{\sin\theta} = \frac{n_4}{n_3}$$

Multiplying these equations,

$\frac{n_1}{n_4} = 1$



112. (3)

Density of mixture = $\frac{2 \times \rho + 1 \times 16\rho}{2 + 1} = 6\rho$

113. (3)

In loop ABC,

$-2i_2 - 3(i_1 - i_2) + 5(i - i_1) = 0$.....(1)

In loop BCD,

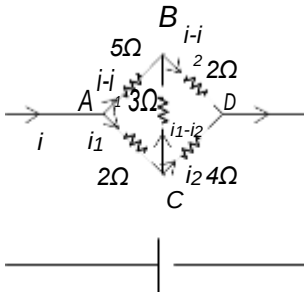
$-3(i_1 - i_2) - 2(i - i_2) + 4i_2 = 0$.....(2)

In loop ACD,

$V - 2i_1 - 4i_2 = 0$.....(3)

Solving we get

$R_{eq} = \frac{V}{i} = 3\Omega$



CHEMISTRY

114. (1)

$$\underset{1\ mole}{N_2H_{4(l)}} + \underset{2\ moles}{2H_2O_{(l)}} \rightarrow N_{2(g)} + 4H_2O_{(g)}$$

$\Rightarrow$ 1 mole N_2H_4 can react with 2 moles of H_2O_2

$\Rightarrow$ 1 mole $N_2H_4 \rightarrow 2 \times 34\ g\ of\ H_2O_2$

$\frac{1}{4}$ moles $N_2H_4 \rightarrow 17\ g\ of\ H_2O_2$

$\Rightarrow$ 0.25 moles of N_2H_4 is reacted

The amount of unreacted N_2H_4 = 0.75 – 0.25 = 0.5 moles N_2H_4

= 0.5 x 32 = 16 g N_2H_4

115. (3)

Collidal solution = $10^{-5} - 10^{-7}\ cm$

True solutions = less than $10^{-7}\ cm$

Suspensions = greater than $10^{-5}\ cm$

116. (3)

$Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$ (or) $Cr_2O_3 + 2Al \rightarrow Al_2O_3 + 2Cr$

It is a reduction of oxide ore to metal

117. (2)

$2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$ is a balanced chemical reaction

118. (3)

	x-rays	UV – rays	IR – rays	Ratio
λ	$1\times10^{-10}\ m$	$1\times10^{-8}\ m$	$1\times10^{-6}\ m$	
$v = \frac{c}{\lambda}$	$c \times10^{10}\ m$	$c \times10^{8}\ m$	$c \times10^{6}\ m$	$10^4 : 10^2 : 1$
$E = hv$	$h \times c \times10^{10}$	$h \times c \times10^{8}$	$h \times c \times10^{6}$	$1 : 10^{-2} : 10^{-4}$

All electromagnetic radiations have some velocity

119. (4)

Electronic configuration (X) = $K^2L^8M^5$ (Z = 15)

$\Rightarrow X^{+3} = K^2L^8M^2 = 1s^2\,2s^2\,2p^6\,3s^2$

Number of p electrons = 6

$\Rightarrow$ one of the allotropic forms of phosphorous is P_4

120. (1)

Compound A = $Cl_2O \Rightarrow 71g\ of\ Cl \rightarrow 16\ g\ of\ O$

$$1\ g\ of\ Cl \rightarrow \frac{16}{71} = 0.225$$

Compound B = $1\ g\ of\ Cl \rightarrow 0.903g\ of\ O$

$$71\ g\ of\ Cl \rightarrow 71 \times 0.903g\ of\ O$$

$$= 64 \text{ g of O} \Rightarrow 4\ O - atoms$$

$\therefore B = Cl_2O_4$ or Cl_4O_8 or Cl_6O_{16}

Compound C $\Rightarrow$ 1 g of Cl $\rightarrow$ 1.354 g of O

71 g of Cl $\rightarrow$ 71 x 1.354 g of O

= 96.134g of O

= 6 O – atoms

$\therefore$ C = Cl_2O_6 or ClO_3 or Cl_3O_4

Compound D = 1 g of Cl $\rightarrow$ 1.579g of O

= 71 g of Cl $\rightarrow$ 71 x 1.579 g of O

= 112 g of O

= 7 O-atoms

$\therefore$ D = Cl_2O_7 or Cl_4O_{14} This data shows law of multiple proportions

121. (3)

$$3Al_{(s)} + 3NH_4ClO_{4(s)} \rightarrow Al_2O_{3(s)} + AlCl_{3(s)} + 3NO_{(g)} + 6H_2O_{(g)}$$

3 moles of Al $\rightarrow$ 3 moles of NH_4ClO_4

3 x 27 g of Al $\rightarrow$ 3 x 117.5 g of NH_4ClO_4

1000 g of Al $\rightarrow$ $\frac{3\times117.5\times1000}{} = 4351.85\ g = 4.351kg$

122. (3)

123. (3)

SO_2 : 32 g of S $\rightarrow$ 32 g of O

9.02 g of S $\rightarrow$ 9.02 g of O

SO_3 : 32 g of S $\rightarrow$ 48 g of O

$$9.02 \text{ g of S} \rightarrow \frac{48\times 9.02}{32} = 13.53g$$

124. (2)

$NH_3 + NH_3 \quad NH_4^+ + NH_2^-$

$\Rightarrow NaNH_2 + NH_4Cl \rightarrow NaCl + 2NH_3$

125. (4)

126. (1)

141. $31513 = x \pmod a$

$34369 = x \pmod a$

$\Rightarrow 2856 = 0 \pmod a$

$2856 = 3\times 8\times 7\times 17$

Let us consider the factor 102.

Then remainder = 97.

142. Let number = x

$\Rightarrow x = 3a + 1,\ x = 5b + 3,\ x = 7c + 5,\ x = 9c + 7$

Let $a = b = c = d$

We observe first term = - 2

For sequence, the common difference = LCM (3, 5, 7, 9) = 315 n^{th} term = (-2) + (n – 1)315

Largest number = 9763

143. $\frac{1000e + 100f + 10g + h}{100} = \frac{10e + f + 10g + h}{2}$

$10e + f + \frac{g}{10} + \frac{h}{100} = 5e + \frac{f}{2} + 5g + \frac{h}{2}$

$5e + \frac{f}{2} = \frac{49h}{100} + \frac{49g}{10}$

$\Rightarrow e = 4,\ f = 9,\ h = 0,\ g = 5$

144. $x(x + y + 1) = 12 \qquad \frac{x}{y} = \frac{2}{3} \Rightarrow x = \frac{2y}{3}$

$y(x + y + 1) = 18$

$\Rightarrow \frac{3x}{2}\frac{5x}{2} + 1 = 18$

$\Rightarrow x\frac{5x}{2} + 1 = 12$

$\Rightarrow x = 2, \Rightarrow y = 3$

$\Rightarrow x + y = 5$

(or)

$\Rightarrow x = \frac{-12}{5},\ y = \frac{-15}{5}$

$x + y = -6$

$\therefore 5 \text{ or } -6$

145. $(217 + 131)(x + y) = 1740$

$x + y = \frac{1740}{5\ 348} =$

146. $x = \frac{1}{2 - x} \Rightarrow 2x - x^2 = 1$

$\Rightarrow x = 1$

147. $a + a + 6d + a + ad =$
$-6\ a + 5d = -2$
$a + 2d + a + 7d + a + 11d =$
$-11\ 3a + 20d = -11$
$\Rightarrow 3a + (-8 - 4a) = -11$
$\Rightarrow -a = -3 \qquad \Rightarrow a = 3$
$a = -1$
$a + 2d + a + 7d + a + 21d = 9 - 30 = -21$

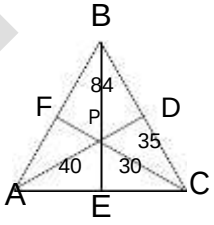
148. $\frac{2(4 + (n-1)3)}{(14 + (n-1)4)} = \frac{23}{35n}$
$\frac{3n + 1}{4n + 10} = \frac{23}{35}$

$13n = 195 \Rightarrow n = 15$

149. Centroid $= \left(\frac{1 + 2 + 3}{3}, \frac{1 - 3 + 4}{3}\right)$
$= \left(2, \frac{2}{3}\right)$

150. $(0, 0), (3, \sqrt{3})$
Third vertex $(0, 2\sqrt{3})$

151. $\Rightarrow \frac{ar(CPA)}{ar(PCD)} = \frac{105}{35} = \frac{3}{1}$
Let BPD = a, APF = b (areas)
$\Rightarrow \frac{a + b + 84}{a} = \frac{3}{1} \Rightarrow b + 84 = 2a$



And

$\frac{ABF}{APF} = \frac{BEC}{PEC}$
$\Rightarrow \frac{124 + b}{40} = \frac{64 + a}{30}$
$\Rightarrow Area\ ABC = 315$

152. $BD = \sqrt{117}$
$\frac{1}{2}\sqrt{117}\sqrt{x^2 + (30 - x)^2} = \frac{1}{2}(x)(30 - x)$
$\Rightarrow 117\left(x^2 + (30 - x)^2\right) = \left(30x - x^2\right)^2$
$\Rightarrow x = 12$
$\therefore Area = 108$

153. A=21,B=21,C=1

154. $ar(PHI) = 36$, $PHI \sim PED \Rightarrow \left(\frac{PE}{PH}\right)^2 = \frac{25}{36}$

$ar(PED) = 25$, $\Rightarrow \frac{PE}{PH} = \frac{5}{11}$

$ar(PFG) = 16$,

So, $\frac{PH}{HE} = \frac{5}{11} \Rightarrow \frac{ar(PED)}{ar(EHC)} = \frac{25}{121}$

Area of PDIC = 60
Area of BHPG = 48
Area of PEAF = 40
$\therefore$Area of ABC = 225

155. Let A(0, 0), B(2a, 0), C(a, $\sqrt{3}\,a$),

Then D $\frac{4a}{3}, \frac{2\sqrt{3}}{3}$

$\Rightarrow 9AD^2 = 28a^2$

$= 7AB^2$

156. $\angle ABT = 29$ as $\angle AOT = 58°$
$\Rightarrow \angle ATQ = 180 - 90 - 29$
$= 61$

157. $\frac{V_1}{V_2} = \frac{4}{9} \times \frac{5}{3} = \frac{20}{27}$

158. $lb = x$, $bh = y$, $lh = z \Rightarrow$ volume $= \sqrt{xyz}$

159. $\tan\theta + \cot\theta = 2$
$\Rightarrow \tan\theta = 1 \Rightarrow \tan^2\theta + \cot^2\theta = 2$

160. $I_1 \rightarrow$ when he draws red ball out of 15
$I_2 \rightarrow$ when he draws red ball out of 20

$P(I_1) = \frac{15 - x}{15}$, $P(I_2) = \frac{20 - x}{20}$

$\frac{20 - x}{20} = 2\,\frac{15 - x}{15}$

$60 - 3x = 120 - 8x$
$5x = 60$
$\Rightarrow x = 12$

$P(I_1) = \frac{1}{1}$.